Solar Influences Data analysis Center

Data Analysis Service supported by the FAGS

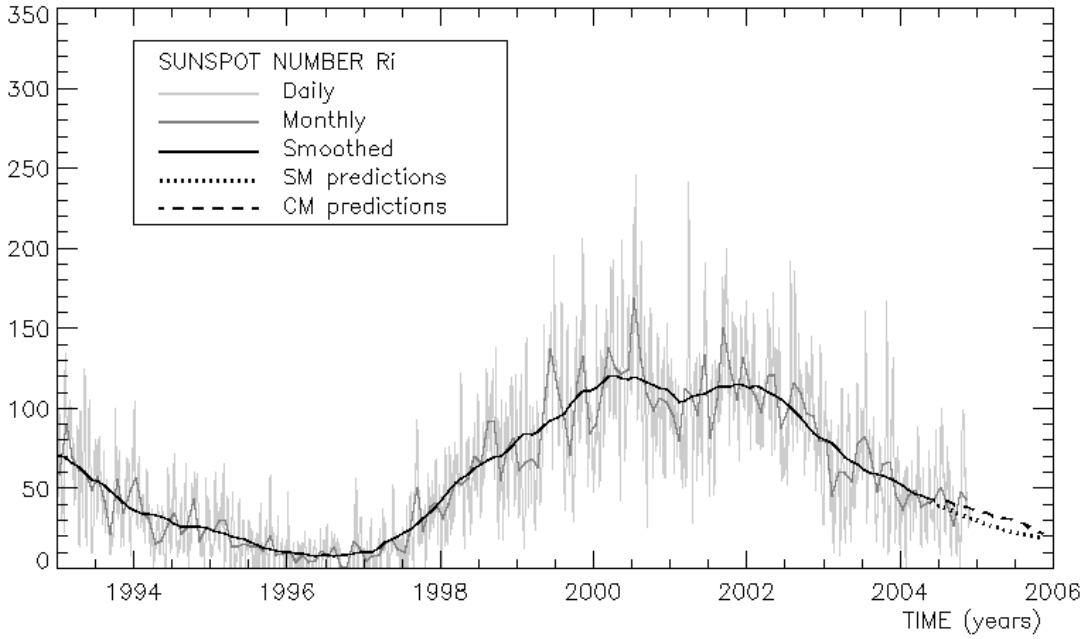
SUNSPOT BULLETIN

2004 n°11

Provisional international and normalized hemispheric daily sunspot numbers for November 2004

computed at the *Royal Observatory of Belgium* using observations from an international network with the *Locarno Specola Solare* as reference station.

Date	R'_I	R'_N	R'_S
1	76	28	48
2	74	29	45
3	67	26	41
4	58	26	32
5	55	23	32
6	62	32	30
7	63	30	33
8	57	30	27
9	52	30	22
10	36	25	11
11	38	24	14
12	38	19	19
13	42	19	23
14	48	24	24
15	44	19	25
16	41	14	27
17	41	11	30
18	38	13	25
19	38	15	23
20	33	14	19
21	26	16	10
22	29	15	14
23	28	18	10
24	34	10	24
25	34	10	24
26	34	9	25
27	37	14	23
28	29	8	21
29	28	7	21
30	32	7	25
Monthly mean	**43.7**	**18.8**	**24.9**
Cooperating stations	**41**	**37**	**37**



Predictions of the monthly smoothed Sunspot Number
using the last provisional value, calculated for May 2004 : 43.9 (± 5%)

	SM	CM		SM	CM		SM	CM
2004 Jun	43	43	2004 Dec	36	37	2005 Jun	28	31
Jul	42	42	2005 Jan	35	36	Jul	26	30
Aug	42	42	Feb	33	35	Aug	25	28
Sep	41	41	Mar	32	34	Sep	24	26
Oct	39	40	Apr	30	33	Oct	23	24
Nov	38	39	May	29	32	Nov	22	22

SM : SIDC classical method : based on an interpolation of Waldmeier's standard curves; the estimated error ranges from 7% (first month) to 35% (last month)
CM : Combined method : the combined method is a regression technique coupling a dynamo-based estimator with Waldmeier's idea of standard curves, due to K. Denkmayr.
ref. : K. Denkmayr, P. Cugnon, 1997 : "About Sunspot Number Medium-Term Predictions", in "Solar-Terrestrial Prediction Workshop V", eds G. Heckman et al., Hiraiso Solar Terrestrial Research Center, Japan, 103

Brussels, December 1, 2004 09:39 UT

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S.I.D.C. SUMMARY OF THE URSIGRAMS

Date	R'_i	PPSI	600	2800	COS	SFI	XI	Ak	SEA
31	91	215	48	139	921	3	2/0	18	
1	76	162	45	136	923	11	1/0	7	
2	74	180	45	133	928	2	0/0	5	
3	67	150	47	136	924	26	4/0	13	
4	58	203	46	136	918	2	0/0	12	
5	55	251	-	141	918	16	2/0	4	
6	62	234	46	129	////	102	4/0	0	
7	63	153	46	130	903	6	0/1	59	
8	57	117	44	124	859	30	1/0	156	
9	52	90	42	127	859	104	1/0	116	
10	36	40	38	105	814	101	0/1	126	
11	38	28	37	95	835	1	0/0	25	
12	38	17	37	97	831	0	0/0	28	
13	42	32	37	96	841	0	0/0	8	
14	48	73	39	100	868	0	0/0	8	
15	44	48	39	106	879	0	0/0	0	
16	41	39	40	108	884	3	0/0	9	
17	41	38	40	105	896	2	0/0	5	
18	38	25	38	104	900	0	0/0	2	
19	38	18	40	102	906	0	0/0	4	
20	33	14	40	99	907	0	0/0	20	
21	26	16	41	101	908	0	0/0	21	
22	29	25	42	106	909	0	0/0	7	
23	28	28	43	107	909	0	0/0	8	
24	34	23	45	107	913	2	0/0	10	
25	34	20	45	109	912	0	0/0	22	
26	34	38	43	111	910	0	0/0	16	
27	37	51	43	110	907	0	0/0	15	
28	29	66	43	113	////	0	0/0	14	
29	28	82	43	111	906	1	0/0	18	
30	32	74	43	111	908	0	0/0	23	

R'_i : provisional international sunspot numbers from the S.I.D.C.

PPSI : prompt photometric sunspot index from the S.I.D.C. in 10-5 w/m^2 : the quantity to be subtracted from the mean solar constant to account for the sunspot contribution.

600 : 600 Mhz solar flux from the station at Humain (Belgium).

2800 : 2800 Mhz solar flux from Ottawa (origin : Ursigrams - UGEOI). The 10.7cm Flux data are a service of the National Research Council of Canada.

COS : thousands of the cosmic ray counts (origin : Ursigrams - UCOSE Terre Adélie).

SFI : From October 1992, Solar Flare Index from the S.I.D.C. (origin : Ursigrams – UGEOR, evaluation : 1 x Sn+10 x "1"+100 x ">1".

XI : X-flares index from the Ursigrams (M-flares/X-flares) (origin : Ursigrams – UGEOR, UGEOI).

Ak : geomagnetic index from Wingst, Germany (origin : Ursigrams).

SEA : sudden enhancements of atmospherics from Uccle & Humain (Royal Observatory, Belgium).

Note that due to problems of interferences saturating our receivers, no SEA could be detected this month.

SOLAR PHYSICS DEPARTMENT

UCCLE DAILY PROVISIONAL RELATIVE SUNSPOT NUMBERS FOR NOVEMBER 2004

DATE	UT	NUMBER OF GROUPS	NUMBER OF SPOTS	RELATIVE SUNSPOT NUMBERS TOTAL	NORTH	SOUTH	CENTRAL	PPSI 10-5 WM-2	QUAL	OBS
3	920	5	39	89	40	49	49	64.8	2	OB
4	1045	5	46	96	44	52	63	184.9	2	OB
5	926	4	62	102	45	57	62	179.9	2	OB
7	950	4	86	126	65	61	65	93.3	2	AZ
9	1015	3	59	89	56	33	0	53.4	2	OB
11	940	4	15	55	33	22	14	26.3	1	AB
13	920	3	37	67	36	31	53	29.9	3	FC
14	1130	4	54	94	46	48	21	80.4	3	FC
15	940	3	30	60	29	31	31	49.4	3	RV
19	1040	5	6	56	23	33	0	13.4	2	OB
20	910	2	4	24	13	11	0	6.4	2	OB
21	940	2	5	25	14	11	0	17.0	3	OB
22	1230	3	11	41	15	26	0	21.2	2	OB
24	925	4	7	47	13	34	13	8.7	3	OB
25	1005	3	11	41	15	26	15	9.5	2	OB
26	950	3	18	48	14	34	14	11.7	2	OB
30	1030	3	12	42	11	31	31	33.2	3	OB

The relative mean sunspot number is 64.8.

NORMALISED UCCLE OBSERVATIONAL SUNSPOT NUMBERS U'=K'U FOR NOVEMBER 2004

K'= 0.876 (*)

1	***	7	110	13	59	19	49	25	36
2	***	8	***	14	82	20	21	26	42
3	78	9	78	15	53	21	22	27	***
4	84	10	***	16	***	22	36	28	***
5	89	11	48	17	***	23	***	29	***
6	***	12	***	18	***	24	41	30	37

The normalised relative monthly mean sunspot number is 57.

(*) K' is the mean of the monthly K' for the last five years.

The Sun has been observed 17 days on 30 possible.

UCCLE OBSERVATIONAL MAJOR SUNSPOT GROUPS FOR NOVEMBER 2004
E AND F BRUNNER'S TYPE GROUPS

Uccle Nø	East Limb Date	Date and type 1st obs	CMP	Last obs	West Limb Date
11-2022	10 22.2	24 C	10 28.9	3 C	11 4.7
14-2022	10 22.7	25 D	10 29.4	4 E	11 5.2
17-2022	10 26.6	28 E	11 2.3	5 E	11 9.1
20-2022	10 27.2	3 D	11 3.0	7 E	11 9.7
21-2022	10 30.3	3 D	11 6.1	11 E	11 12.8
22-2022	10 28.1	7 C	11 3.8	9 E	11 10.6
2-2023	11 5.0	11 C	11 11.8	15 E	11 18.5

PROBABLE RETURN OF MAJOR GROUPS FOR DECEMBER 2004

Nø	New East Limb	New CMP	New West Limb
11	11 18.0	11 24.7	12 1.5
14	11 18.8	11 25.6	12 2.3
20	11 23.2	11 29.9	12 6.7
21	11 26.5	12 3.3	12 10.0
22	11 23.9	11 30.6	12 7.4
2	12 2.1	12 8.8	12 15.6

MONTHLY SUMMARY OF SOLAR AND GEOMAGNETIC ACTIVITY

I. Solar Activity

The sun showed a high level of activity in the first 10 days of the month, with as largest event an X2.5 flare on Nov 10. Nearly all this fury originated from Catania sunspot group 61 (NOAA 0696), a fairly large group of some 40 spots. When this group disappeared, solar activity became much lower for the rest of the month, with occasional bursts of C-flare activity.

The month started with a continuation of the high level of solar activity that characterized the end of October. In the first few days of the month most of the flares were produced by Catania sunspot groups 52 and 49 (NOAA 0691 and 0687), including two M-flares from Catania 52 on Nov 01 and 03. Another complex sunspot group in these early days was Catania 57 (NOAA 0693), which had a beta-gamma magnetic configuration (even beta-gamma-delta on Nov 04-05). However, it remained rather quiet and produced only weak C-flares. The M1.1 flare on Nov 01 was associated with a faint partial halo CME first seen in the SOHO/LASCO C2 field of view at 03:54 UT. This CME did not reach Earth. A proton event occurred on Nov 01, starting around 06:00 UT. The >10 MeV component was above the event threshold until about 18:00 UT. The source region (probably the former Catania 43, NOAA 0684) was situated behind the west limb.

From Nov 03 onwards Catania sunspot group 61 (NOAA 0696) dominated solar activity. During Nov 03-10 it produced 13 M-flares, while it also released an X2.0 flare on Nov 07 and the largest flare of the month, an X2.5 on Nov 10. Most of these flares were accompanied by full or partial halo CMEs. Halo CMEs first appeared in the LASCO C2 field of view at:

- 03:54 UT on Nov 03 (approximate plane of the sky speed 750 km/s), associated with and M1.6 flare from N09E45
- 16:06 UT on Nov 03 (1000 km/s), associated with an M5.0 flare from N09E38
- 09:54 UT on Nov 04 (600 km/s) associated with a C6.3 flare from N09E28,
- 23:30 UT on Nov 04 (1000 km/s),
- 01:31 UT on Nov 06 (960 km/s),
- 16:30 UT on Nov 07 (1770 km/s) associated with the X2.0 flare from N09W17,
- 03:54 UT on Nov 08 (520 km/s), associated with a C7.9 flare from N08W20,
- 17:26 UT on Nov 09 (1700 km/s), associated with an M8.9 flare from N08W51,
- 02:26 UT on Nov 10 (1560 km/s), associated with the X2.5 flare from N09W49.

All these CMEs had clear low corona signatures (coronal dimmings and EIT waves) detected by SOHO/EIT. The CME-driven shock of Nov 07 produced a particle event with the >10 MeV proton flux surpassing the threshold around 17:00 UT on Nov 07, and remaining above the threshold until noon on Nov 13. The >50 MeV proton flux also exceeded the event threshold very briefly on Nov 10. The Nov 09 flare triggered a filament eruption.

The magnetic configuration of the flaring region Catania 61 had a photospheric neutral line approximately in East-West direction with the positive polarity at its northern side. This means that the ejected interplanetary flux ropes had a southwards oriented leading magnetic field. This is a favorable configuration for producing significant geomagnetic disturbances.

After Nov 08, Catania 61 experienced a strong and steady decay. However, it kept its complex beta-gamma-delta magnetic configuration until its disappearance at the West limb on Nov 12. Solar activity dropped abruptly to very low levels after the Nov 10 X2.5 flare. Only B-flares were recorded, with an X-ray background decreasing to the B1 level. This very quite period lasted until Nov 15.

During this time, some smaller active regions showed significant growth. One of them was Catania 65 (NOAA 0700), which took a beta-gamma magnetic configuration on Nov 13. This sunspot group then became the dominant source of solar activity, producing all of the C-class flares, and most of the smaller flares as well. On Nov 15 and Nov 16, it was fairly active, with respectively 3 and 5 C-flares. From about noon on Nov 16 until late on Nov 18, flaring activity from Catania 65 and thus solar activity as a whole became very low, with only some tiny B-class flares on an X-ray background near B2 level. On Nov 18, sunspot group 65 rotated over the west limb, but while doing so, it generated a final burst of flaring activity, producing 3 C-flares on Nov 18 and another 3 on Nov 19, all of these effectively from behind the solar limb. With the disappearance of Catania 65, solar activity dropped to very low again. The X-ray background briefly touched the bottom of the B-scale on Nov 20-21, but slowly increased in the course of Nov 21, with the development of some small flaring activity in Catania sunspot groups 66 (NOAA 0701) and 70 (NOAA 0704). The latter of these was probably the return of Catania sunspot group 52 (NOAA 0691), which generated X-flares on its previous rotation, but had decayed to a rather insignificant small group during the transit over the far side of the sun.

On Nov 24 Catania sunspot groups 77 and 78 (NOAA 0707 and 0706) turned on the disk, but already on Nov 22 GOES recorded a long-duration C-flare from behind the east limb, probably from Catania 78. Both groups produced several C-flares, the biggest one a C9.8 flare from Catania 78 on Nov 24. On Nov 25 the returning very active region Catania 61 (NOAA 0696) produced a C2.6 flare from behind the east limb, but it only turned on the disk on Nov 27 (as Catania 79, NOAA 0708). Also this region had become quieter, however, and only a few more C-class flares were observed from Catania 77 and 79 during the last days of the month.

II. Geomagnetic Activity

After a quiet start, geomagnetic conditions reached severe storm level on Nov 7-10 due to the impact of several coronal mass ejections. The estimated NOAA Kp index reached the maximal value of 9 several times during this period. After Nov 10, things became much calmer and the rest of the month was mostly quiet with occasional active conditions. Short periods of minor storm level occurred on Nov 12, Nov 20-21 and Nov 25.

In spite of the numerous halo CMEs, the geomagnetic situation was mostly quiet until Nov 07 (except for a short active period late on Nov 03). The geometric conditions were unfavorable for the arrival of the halo CMEs of Nov 01 and 03, as the source was situated too far from the central meridian. However, a series of interplanetary shocks was observed by ACE and SOHO/CELIAS on Nov 07. SOHO/CELIAS times of shock arrivals were 02:22 UT, 10:22 UT and 17:59 UT. The cold ICME matter arrived late on Nov 07. This was probably a compound disturbance produced by the interaction of halo CMEs that erupted on Nov 03-04. The compound ICME contained strong (up to -50 nT) southward interplanetary magnetic field, resulting in a severe geomagnetic storm on Nov 07-08. This first storm ended by Nov 08 15:00 UT, and the geomagnetic field was unsettled for a few hours. After a peak of 700km/s, the solar wind speed decreased steadily, while the Bz component of the interplanetary magnetic field turned from a minimum of -45nT to a +10nT northward orientation.

The geomagnetic conditions returned to major storm levels later on Nov 08, as Bz turned again southwards. The activity rose further to severe storm levels on Nov 09, continuing on Nov 10, in response to a new double shock. A first shock on Nov 09 at 09:55UT, probably from the CME associated with the M9 flare of Nov 06, induced a solar wind speed jump from 600 to 800km/s. Soon after, a second shock at 18:24UT, from the CME associated with the Nov 07 X2 flare, produced a 1-hour pulse, with Bz=-45nT at 18:52 UT. The IMF turned northward but slowly

rotated back southward on Nov 10. This very long geomagnetic storm finally subsided around 18:00UT on Nov 10. The geomagnetic field was subsequently active.

Then, weak glancing blow shocks reached the Earth on Nov 11 at 17:14 UT and on Nov 12 at 01:30 UT. Those disturbances, associated with the halo CMEs of Nov 09 and 10, produced a peak solar wind speed of 650km/s and a -12nT Bz pulse. This triggered a minor storm on Nov 12. Thereafter, the solar wind speed declined to 450km/s, with Bz fluctuating around 0. The geomagnetic field became quiet until Nov 20. During this period the solar wind speed was low (varying between 300 and 450km/s). On Nov 16 some small perturbations in the solar wind caused short intervals of southward orientation of the IMF, but this did not lead to significant geomagnetic perturbations.

On Nov 15-16 a small coronal hole in the northern hemisphere was situated near the central meridian. The fast flow from this coronal hole started to influence the geomagnetic field from the evening of Nov 19 onwards. The wind speed increased in three steps to slightly more than 600km/s. The north-south component of the IMF was very variable, with short period of southward orientation. This led to active geomagnetic conditions on Nov 20-21. Another small coronal hole passed the central solar meridian on Nov 21 and caused active to minor storm conditions on Nov 25-27. A third, trans-equatorial coronal hole was situated at the center of the solar disk on Nov 27. The solar wind speed increased on Nov 29 and 30 to reach a maximum of 620km/s on Nov 30. This produced again active conditions on Nov 29-30.

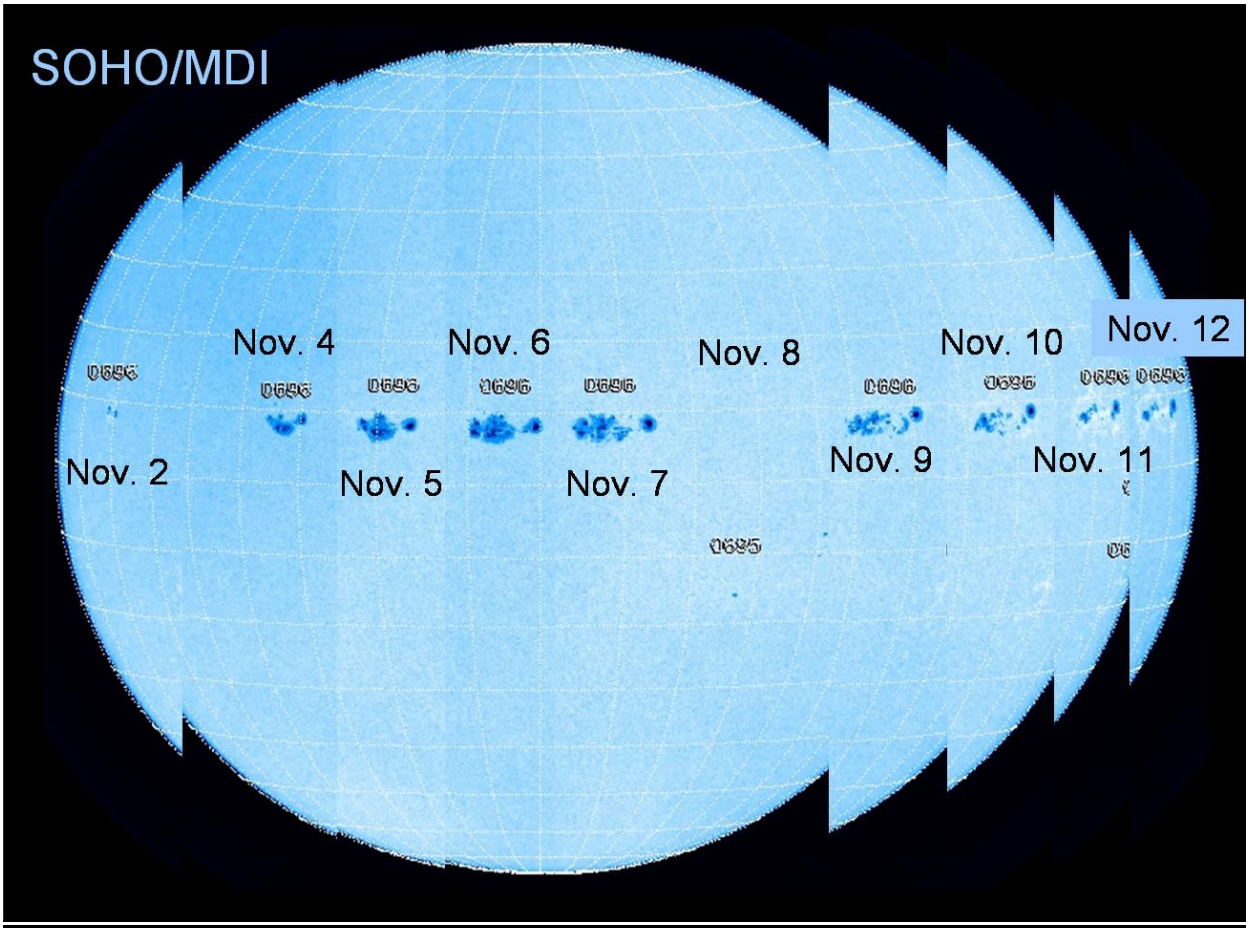
III. Noticeable solar events

DAY	BEGIN	MAX	END	LOC	XRAY	OP	10CM	RADIO TYPE	600 (Humain)	Cat	NOAA	NOTE
01	0304	0322	0326	N15W41	M1.1	1F		III/1,II/2		52	0691	
03	0123	0133	0137	N13W71	M2.8	1F	170	III/1,II/2		52	0691	
03	0323	0335	0357	N08E45	M1.6	1N	1100	IV/2,V/3,III/3, II/3,CTM/2		61	0696	
03	1535	1547	1555	N11E40	M5.0	SN	1700	II/3,IV/2	1552	61	0696	
03	1803	1826	1835	N09E32	M1.0	SF	380	III/1		61	0696	
04	2142	2229	2253	N11E19	M2.5	1N	1800	CTM/1,II/1		61	0696	
04	2253	2309	2326	N08E18	M5.4		1500	IV/1		61	0696	SXI derived location
05	1123	1130	1133	N08E15	M4.0	1F	440			61	0696	
05	1910	1922	1932	N10E06	M1.2	SF				61	0696	
06	0011	0034	0042	N10E08	M9.3	2N	2700	IV/2,II/1		61	0696	
06	0044	0057	0110		M5.9				61	0696		
06	0140	0157	0208		M3.6					61	0696	
06	1938	1953	2003	N09W06	M1.4					61	0696	SXI derived location
07	1542	1606	1615	N09W17	X2.0		4600	II/1,IV/1		61	0696	SXI derived location; halo CME
08	1543	1549	1552	N08W35	M2.3	1N	56	V/2	1546	61	0696	
09	1659	1719	1732	N07W51	M8.9	2N	1000	IV/3,III/2,II/3		61	0696	full halo CME
10	0159	0213	0220	N09W49	X2.5	3B	650	IV/1,II/3,III/3		61	0696	

loc: approximate heliographic location
Xray: X-ray flare class
op: optical flare class
10 cm: 10 cm radio flux
type: type of radio burst

600: peak time (UT) of 600 Mhz radio bursts in Humain
Cat: Catania sunspot group identification
NOAA: NOAA active region identification
p: proton event
CME: Coronal Mass Ejection

IV. Picture of the month



A. Zhukov made this composite image showing the evolution of Catania sunspot group 61 (NOAA 0696) as it transited the solar disk. The individual images were obtained with the MDI instrument onboard the joint ESA/NASA mission SOHO.